

Ex-ante Moral Hazard: Impact of Health Insurance on Health Behaviors

Abstract

Ex-ante moral hazard constitutes a considerable role in insurance theory. It arises when the existence of insurance leads to a reduction in prevention/healthy behaviours. Although there are many theoretical studies dealing with the effect of insurance on preventive efforts, the empirical studies are rather limited. Due to unknown causality between insurance status and prevention/health behaviours, the correlation can be ambiguous if it is not possible to observe the temporal sequences of insurance status and preventive efforts. Recently, empirical studies apply instrumental variable technique to tackle the endogeneity problem; however, reliability of the results depends on the validity of the selected instruments. The aim of this paper is to analyse the effect of health insurance on health behaviours; smoking, weight, and exercise for the working population (ages between 18-64) in U.S. by using 2006 data from the Behavioral Risk Factor Surveillance System (BRFSS). Employment status which is perceived as a valid instrument is used as the instrumental variable in the regression analyses. The results of this paper indicate that, by using an instrumental variable, health insurance has ex-ante moral hazard effect on some of the health behaviours. Assuming that the instrument is valid, people who have health insurance are more likely to be obese and less likely to exercise. However the impact of insurance on smoking does not reach a statistical significance.

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1. Introduction

Ex-ante moral hazard constitutes a considerable role in insurance theory. It arises when the existence of insurance leads to a reduction in preventive efforts whose cost to the individual remains the same after the receipt of insurance as well as before the receipt of insurance. Erhlich and Becker (1972) has made one of the major contributions to the existing literature about insurance and its implications on preventive behaviors. They show that insurance can lead to less prevention because marginal gain of prevention is decreased due to the reduction in income loss in existence of insurance. In fact, they also show that if the insurance premiums can be settled according to the level of preventive efforts, this can lead more prevention because the expenditure on insurance will be less for the insured (Erhlich & Becker 1972, p.641). Even though it is possible to overcome ex-ante moral hazard problem by this theory, this argument contradicts with real life outcomes, since monitoring some of the preventive efforts can be costly and most of the time unattainable. For example, the level of exercise which an individual does can not be perfectly measured by the insurance provider, that is asymmetric information is created within the market, and this contributes to ex-ante moral hazard problem, and thus weakens the applicability of theory developed by Erhlich&Becker (1972).

For example, in the United States, employer provided health insurance¹ is the most common provision of insurance. Employer, compared to individuals has larger bargaining power (positively correlated with the size of the firm) resulting in relatively lower premiums. It is also advantageous for the insurer because having an insurance pool spreads the health risks, given the reason for the pooling is not merely to get an insurance but employment. This yields an overall benefit to the insurer even though he does not monitor for individuals and their preventive activities. Consequently self employed people generally pay higher premiums than wage earners given the identical health conditions. Considering this feature of insurance market in the U.S., ex-ante moral hazard is an important concept that deserves attention.

However, there are some views that it is not relevant to treat the health insurance market like any other insurance markets, and likewise, it can be misleading to consider health as any other commodity which can be insured against potential risks, so ex ante moral hazard is not necessarily be observed in existence of health insurance. For instance, Cook & Graham (1977) suggests that

¹ Further information about health care system in U.S. will be given in Section 2.

even if there is full health insurance coverage, it is still possible for individuals to exert preventive effort due to the perception of health as an “irreplaceable commodity”. They defend that insurance can only offer monetary compensation and for some individuals health deterioration cannot be fulfilled by money. On the contrary to that, Kenkel (2000) suggests that if the cure covered by an insurance eliminates the health deterioration by the help of technological advances, then the presence of insurance can make prevention and cure as “nearly perfect substitutes” and therefore enlarging the impact of ex-ante moral hazard. Undoubtedly, these two opposite arguments heavily depend on the awareness and perceptions of individuals about prevention and health status.

Data supports that some people in the U.S. do not seem to be well aware of the importance of prevention. For example, “each year, an estimated 438,000 Americans die as a result of smoking or exposure to second-hand smoke, and for each person who dies from a smoking-related disease, about 20 more are living with a smoking-attributable illness. The estimated costs of smoking-related medical expenses and loss of productivity exceed \$167 billion annually” (Sustaining State Programs for Tobacco Control Data Highlights, 2006). Besides, “1998 aggregate adult medical expenditures attributable to being overweight and obesity is estimated to be \$51.5 billion using Medical Expenditure Panel Survey data and \$78.5 billion using 1998 National Health Accounts (NHA) data. For obesity alone, the estimated costs are \$26.8 billion and \$47.5 billion, respectively” (Finkelstein, Fiebelkorn, and Wang 2003, cited in Economic Consequences of obesity and overweight, CDC). Albeit, it is not certain how much of these expenditures merely belong to the insured people who engage less in prevention (ex-ante moral hazard), these figures are helpful to bear in mind the macro aspect of ex-ante moral hazard, and by itself, can also be of great importance due to the cost externalities it might create on the aggregate economy both as a direct health care costs and indirect costs stemming from productivity losses (Zweifel & Manning 2000).

Although, there is a considerable number of studies dealing with ex-ante moral hazard with theoretical models (mostly based on expected utility models), the empirical studies are rather limited. Since the behavioral implication of insurance is difficult to examine, the findings across different studies can yield in different conclusions. Moreover, due to the reverse causality between insurance status and preventive health behaviors (i.e., individuals tend to engage less in prevention after the receipt of insurance or they prefer to get insured because they do not engage in prevention), especially in cross sectional data sets, the correlation can be ambiguous. . Nevertheless, identification of ex-ante moral hazard can be relatively more reliable if it is possible to observe the temporal sequences of insurance status and preventive efforts.

Recently, empirical studies employ instrumental variable technique to tackle the endogeneity problem, however, reliability of the results (whether they indicate ex-ante moral hazard or not) depends on the appropriateness of the selected instruments. Many of those studies which examine U.S. markets, the instrument is employment status. The main reason for this association is due to the disparity in insurance benefits among employment statuses as well as among the size of the firms which have already been mentioned above. Moreover, there are studies showing that self employed people are less likely to be insured than wage earners (Holtz-Eakin et. al, Perry & Rosen 2001a, Perry & Rosen 2001b). In the existing literature, for example, Meer&Rosen (2004) used self-employment status (corporations, sole proprietors, and partners regarding the diversity among the insurance offerings to the aforementioned different organizational forms) as instruments when examining the effect of insurance on health care utilization. On the other hand, Rashad& Markowitz (2007) preferred to use firm size as instrument in order to explain the effect of insurance on obesity.

The aim of this thesis is to examine the ex-ante moral hazard impact of insurance on some of the health behaviors; smoking, weight, and exercise by using recent data (2006) from the Behavioral Risk Factor Surveillance System (BRFSS), which is a one year cross sectional survey data. The reason for these behaviors to be chosen is that they are the most typical preventive efforts whose costs are the same for each individual whether he has insurance or not. Considering the reverse causality of health insurance status and health behaviors, instrumental variables technique is employed, in accordance with some of the previous studies mentioned above. The instrument for this analysis is “employment status” of the individual, either self-employed or wage earner which has been used as an instrument for insurance in the literature of some other studies, but it has not previously used to examine ex-ante moral hazard impact on health behaviors.

The structure of the thesis as follows: In section two, a brief overview of the health care system in the United States is presented. Section three reviews the existing literature mainly focusing on recent empirical studies dealing with ex-ante moral hazard effect of insurance. Section four presents the methodology, the data, and the estimation techniques. The regression results are presented in section five. In order to make more robust interpretations and as a sensitivity analysis of the model, sample size is restricted to people who are between 18-55 years, and the results of the regressions are presented in section six. An overall discussion of the findings including the limitations of the model is presented in section seven, followed by a concluding section.

2. Overview of U.S Health Care System

In U.S., both public and private insurance are offered. The national insurance programs are mainly Medicare and Medicaid which are targeted to specific groups. For instance, Medicare offers a health insurance program for people at the age of 65 and older, and for younger adults having permanent disabilities. In 2007, nearly 44 million people rely on Medicare for their health insurance coverage: 37 million people age 65 and over and 7 million people under age 65 with disabilities². Though each individual receives a portion of the compulsory benefit of Medicare, the coverage for several health care utilizations is highly fragmented and varies among individuals. The Medicaid is another national program especially designed for the low-income and disabled. In addition, it also offers coverage to very poor pregnant women, children, elderly, disabled, and parents. The program recently covers over 58 million Americans, including 8 million persons with disabilities and 6 million low-income frail elderly and disabled Medicare beneficiaries who rely on Medicaid to fill Medicare's gaps³. However, the eligibility criteria differ from state to state and it is problematic for many poor individuals who are poor to get a private insurance but wealthy enough to become eligible for Medicaid.

There are also other national insurance programs such as S-CHIP The State Children's Insurance Program which offers health care coverage to children whose families are not eligible for Medicaid though they cannot afford to purchase private health insurance. Finally, The Veteran's Administration is another national health care program provided for veterans of the military and the health care is provided in facilities are specific for veterans.

The aforementioned health care provisions indicate that there is a large part of the American population (i.e. working population) who cannot benefit from these national programs. However, in U.S., mostly health insurance is acquired by the employees through their workplace. The employer-provided insurance plans are settled by the employer and the insurance company, and the employees are given the health insurance as long as they continue to work for the firm. As mentioned in the previous section, in employer-provided insurance markets, the employer is a larger buyer than individuals so the insurance companies can offer advantageous premiums and fixed coverage for each employee, since they can spread their risk by the heterogeneous formation of a group of employees in terms of health conditions. The large portion of the health insurance premium is paid by the employer and the remainder are paid by the employees, however, the premiums depend on

²Kaiser Family Foundation, *Medicare, A Primer*, 2007.

³ Kaiser Family Foundation, *Medicaid's role for people with Disabilities*, 2008.

the coverage rate which is determined by the employer. In 2006, 61% of the employers offered health benefits and in 2007, the rate was 60%. The firm sizes play a major role in insurance offer rates. For instance, 45% of the firms which have 3-9 workers offered health insurance in 2007 whereas 99% of the firms which have more than 200 workers offered health insurance. However, it is not guaranteed to offer insurance to every worker in the same firm depending on the affordability of the employer (Employer Health Benefits, Kaiser Family Foundation, 2007).

Although the wage earners are covered by health plans through their workplaces to some extent, for self employed people the only option is to get a private individual health insurance whose premiums have to be paid by the insured. Since it is easier to monitor individuals in private insurance markets, it is more likely that self employed individuals pay relative higher premiums than wage earners pay given the identical health conditions.

3. Literature Review

Ex-ante moral hazard has been mostly discussed theoretically, therefore the empirical studies in the existing literature are rather limited.

One of the attempts regarding this phenomenon has been made by Kenkel (2000) where he examined the effect of health insurance on some of the preventive behaviours using the 1990 National Health Interview Survey. He found little evidence of ex-ante moral hazard effect of insurance, only men who are insured were found more likely to be obese. Besides, he concluded that people who have insurance are more likely to engage in prevention. However, his analysis shows reasonable grounds for suspicion, since he did not consider the reverse causality between insurance and preventive behaviours.

However, there are other studies taking the causality problem into account. For example, Courbage and Coulon (2004) studied the ex-ante moral effect of insurance on exercising, smoking, breast screening and cervical smear test using data from the 2000/2001 wave of British Household Panel Survey by applying the instrumental variables technique. Their analysis did not result in any significant ex ante moral hazard effect. On the contrary, they found that people who have private health insurance are more likely to exercise.

Recently, another empirical research has been done by Rashad&Markowitz(2007) about the association between health insurance and obesity using the 1993-2002 BRFSS data. Considering the weight control as prevention, they tried to identify the ex-ante moral hazard effect of insurance on

obesity. Similar to the previous studies, they applied instrumental variables approach using the “firm sizes” as the instrument for insurance. Even though, they modified their model by restricting the sample to healthy individuals and controlling for the physician visits so as to reduce the possibility of reverse causality, their models failed to find significant impact of insurance on the probability of being obese. They acknowledged that the results might indicate the problematic instruments.

Another empirical study which has great contributions to the ex-ante moral hazard literature is pursued by Dave & Kastner (2006). They identified the ex ante moral hazard effect of having Medicare compulsory health benefit among elderly people. They used both a longitudinal(Health and Retirement Study 1992-) and a cross sectional(1994-2005BRFSS) data in order to compare their results. One peculiar aspect of their study is that they indicated that having a health insurance can also encourage prevention due to higher opportunities of physician contacts. They argue that increased physician contacts can yield more exposure to health knowledge and awareness so that having a health insurance can also help individuals to engage in health promoting behaviours. They selected primary preventive behaviours; smoking, weight, exercise and heavy drinking to be researched. After controlling for physician visits, they found evidence of ex-ante moral hazard that Medicare is associated with less preventive effort among elderly people. Moreover, they also found empirical evidence that physician visits improve health behaviours.

The most recent research has been conducted by Stanciole (2007). He examined the ex ante moral hazard effect on “life style choices” namely as smoking, heavy drinking, obesity, and sedentarism using the data from the 1999, 2001 and 2003 waves of the Panel Study of Income Dynamics. In particular, he also considered that these lifestyle choices could be “interdependent” decisions. By taking this into account, he found evidence of ex-ante moral hazard that having a health insurance raises the incentive to smoking, sedentarism and obesity. However, for heavy drinking, the presence of insurance decreases the incentive to heavy drinking. Moreover, he also found that life style choices can show interdependent patterns. The results indicate that heavy smoking and heavy drinking can be said as complementary life style choices as well as obesity and sedentarism , whereas heavy drinking and obesity can be said as substitutes.

4. The Model

4.1 The Methodology

The hypothesis is people who have insurance are less likely to engage in prevention. Therefore, the model below is constructed so as to identify the effect of having health insurance coverage on health behaviours. Three different health behaviours, specifically smoking, exercise and weight are used as dependent variables in the regression equations where the key explanatory variable is the health insurance status.

In addition to the explanatory variable, in line with the previous empirical studies, economic and demographic characteristics of the survey respondents are also included as control variables. There are many studies showing the effects of gender differences on several health behaviours. For instance, Jha et al. (2002) studied the global and regional smoking prevalence according to age and gender differences and find that global smoking prevalence is higher for men than women. According to Grossman's seminal work, income and education are proposed to have positive effects on an individual's perception and valuation of his own health and leading him to become a better health producer (Grossman 1972). Moreover, he suggests that demand for prevention is replaced by demand for curative care as age increases. In addition, race difference can also result in different behaviour characteristics including risky behaviours probably due to cultural diversity. In addition to the aforementioned indicators, marital status, number of children under 18 in the household are also relevant considering that they may become temporarily stress sources to individuals, or might impose additional responsibility to the individual, ultimately resulting in an association with preventive behaviours. From a psychological point of view, it is reasonable to expect that satisfaction with life in general can constitute a stimuli for an individual to invest in her health, i.e., having a healthier lifestyle. In the literature, it is shown that life satisfaction and optimism have effects on general health behaviours (Ylöstalo et al. 2003). Therefore, another variable controlling for the life satisfaction of the individuals is included in the model.

As explained previously, Dave&Kaestner (2006), focused on the impact of physician counselling on preventive behaviours. In their study they controlled for physician visits in order to capture the pure ex-ante moral hazard effect. Given the health behaviours are generally addressed during the routine check ups, rather than visits to address acute or chronic conditions, having a routine check up during the last year is included as a covariate in the models, in accordance with Dave&Kaestner (2006).

As mentioned in the Introduction section, employment status is chosen as the instrumental variable in the models since the previous studies give sufficient support for using employment status as an instrumental variable which has a high correlation with insurance status to overcome the reverse causality problem which lies on the basis of the model.

However, reverse causality is not the only obstacle while constructing the model. Despite the control variables are quite many, there is still room for unobserved variables which could influence the individuals' choices of both insurance and prevention resulting in omitted variable bias which threatens the internal validity of the model. For example, risk aversion can be considered as an unobserved factor which explains both insurance and prevention preferences (Kenkel 2000). Alternatively, discount factor, or time preference, can also lead to omitted variable bias. The outcomes of the current prevention requires an effort today which offers benefits not in the short run but in the long run. If for an individual the utility gained in the future is less valuable than the utility gained today, then it is more likely not to expect him to invest in prevention (J. Komlos et al. 2004). Following the same approach, Rashad&Markowitz (2007) suggests that time preference might be a factor jointly determining the choice of prevention and insurance. Similarly, according to the psychological theory of cognitive dissonance, people who engage in risky behaviours can adopt their beliefs in order to justify their behaviors (Aaron J. Louie 1997). To give an example, a smoker can think that smoking can not harm him, and everyone can get a cancer but him. Moreover, this wrong cognition might even lead him to delay getting an insurance or ignore the necessity of an insurance. Alternatively, people who report excellent, very good or good health status might believe that their health status is good enough not to engage in further healthy behaviours, because smoking or not exercising can not harm them and they can even refuse to get insurance due to their excess confidence on their health status. This example is again in accordance with the implications of cognitive dissonance theory and erects a potential source of omitted variable bias. However, since health status is an observable variable, it is possible to include a dichotomous variable indicating whether individual has a better or good health or not in all of the models.

These are some of the examples showing the possible heterogeneity among individuals which remains unobserved except for the health statuses of individuals. In order to account for omitted variable bias, instrumental variable approach is also a relevant tool which is widely used in empirical studies. Hence, the model in this thesis also requires an instrumental variable not only because of the simultaneous causality problem but also the omitted variable bias problem.

4.2 Data

For the analysis, 1 year cross section data set is employed from the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is the largest telephone based survey which has been conducted annually since 1984 so as to get information from U.S residents regarding health care access, utilization, and health behaviours. The survey is conducted by U.S State health departments and also supported by Centers for Disease Control and Prevention (CDC). The data are collected upon random sampling of phone calls made with one individual per household who is older than 18 years. 2006 BRFSS data consists of 355,710 individuals. These data are publicly available from the CDC. The sample which is selected for the analysis closely related to the active work force due to selected instrumental variable, consists of people who are either self-employed or wage earners and are at the ages between 18-64. People aged 65 or older and disabled people were excluded because they can receive insurance coverage from government sponsored programs (e.g., Medicare, Medicaid). The final sample has 156,928 individuals.

One of the health behaviours, (chronic) smoking is determined as a binary dependent variable regarding the question of “Do you now smoke cigarettes every day, some days, or not at all?”. Individuals who respond “daily” are assigned the value one, and some days and not at all are assigned the value zero. However, this might lead to loss of some information, since it can be possible to capture the effects of insurance status and several control variables on various thresholds of smoking habits and in order to justify the results that are found above, another categorical smoking variable is also designed having three categories. The first category consists of people who are non smokers. The next category consists of people who are occasional smokers and the last category consists of people who are daily smokers. Obesity. The calculations are done by Body mass index formula⁴ which is the weight (kg.) divided by the square of height (m.) and then people who have a BMI higher than or equal to 30.00 are defined as obese. Due to same reasons, three categories are defined according to BMIs. First category is neither overweight nor obese people($BMI < 25$), the second category is overweight people($25 \leq BMI < 30$) and the third is obese people. These multi categorical regressions are done in order to justify the regression results and to gain more insight of ex-ante moral hazard on various thresholds. Therefore, their results will be reported in Appendix.

The last health behaviour is exercise and it is designed as a binary response variable upon the question “During the last month other than your regular job, did you participate in any physical

⁴Body Mass Index is taken for granted according to the definition of Center for Disease Control and Prevention(CDC).

activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?” . Individuals who respond “yes” are assigned the value one, and “no” responses are assigned the value zero.

The BRFSS data also include information on economic and demographic characteristics. All models include the following variables (Table 1): Insurance status, health status(fair/poor health is the omitted category), age, number of children under 18 years in the household, gender, race as represented by indicators for White non Hispanics (the omitted reference category), Black non Hispanics, Hispanics, and Other races (primarily Asian, Native Hawaiian or Pacific Islander, American Indian, Alaska Native), having a routine check up during the last year as an indicator for physician visit, level of education as represented by dichotomous indicators for less than high school degree (the omitted reference category), high school degree, some college education and college degree; annual household income(less than 15,000\$ annual income is the omitted reference category), marital status indicators for married and divorced/separated people, and satisfaction with life (satisfied with life is the omitted reference category).

The instrument is derived from “employment status”. Individuals reporting that they are wage earners are assigned to take value 1 and self employed responses take zero value. Since the instrument is either wage earner or self employed, the other occupations and associated respondents are excluded from the regressions. This leads to exclude 44.2% of the sample who are neither self employed nor wage earners, however, since the sample size is 156.928 it is still plausible to proceed with the regressions.

4.3 Estimation

Even though it is possible to use OLS in case there is sufficient number of observations while estimating the probability of the dependent variable, logistic regression allows to overcome many of the restrictive assumptions of OLS regression. For this reason, logistic regressions are used in all of the analyses.

The regression model is in the following form;

$$P_i = E(Y = 1|X_{2i}) = \frac{1}{1 + e^{-(\beta_1 + \beta_2 X_{2i} + \sum_{k=3}^K \beta_k X_{ki})}}$$

where i index the individuals, Y represents “smoking”, “exercising”, and “obesity” status for each and every separate regressions. X_{2i} represents a dummy indicator for health insurance and $\sum x_{ki}$

represents control variables.

Each behaviour is analysed separately and regressions is run disregarding the endogeneity first, and then Hausman simultaneity test is applied in order to see if reverse causality exists. Even if Hausman causality test rejects the simultaneity, it is still necessary to insert instrument due to unobserved factors determining both insurance and prevention statuses.

All analysis are run by using (Stata, version 9.2; StataCorp, College Station, Texas). “svy” commands on Stata 9.2 which is designed especially for analysing data from sample surveys is used. This command uses a robust variance estimator and incorporates the effect of clustering and stratification as well as the effect of sampling weights when computing the variance, standard error, and confidence intervals, and enables to generalize the results to U.S. Sampling weights are taken directly from BRFSS dataset. The purposes of weighting the BRFSS data are to compensate for unequal probabilities of selection, to adjust for non-response and telephone non-coverage, to ensure that results are consistent with population data and to make population estimates.⁵

All tables report the results in odds ratios. Odds ratio is a measure of effect size and mostly preferred to be reported in logistic regression outputs. An odds ratio is the ratio of two odds. It is a way of comparing whether the probability of a certain event is the same for two groups where the groups are mostly defined by the dichotomous variable in the regressions of this study. For example a dummy variable referring to gender of the individual creates two groups, namely females and males.

An odds ratio of 1 implies that the event is equally likely in both groups, that is the independent and the dependent variables are independent. An odds ratio greater than 1 implies that the event is more likely in the first group. An odds ratio less than 1 implies that the event is less likely in the first group. For example an odds ratio of 1.2 for “Male” variable in a regression should be interpreted as; the likelihood of an event occurring is 20% higher for men than women. Alternatively, males are 20% more likely to experience the event than female. For continuous independent variables such as age in this model, odds ratio greater than 1 should be interpreted as a unit increase in age is associated with an increase in the odds of the occurrence of the event. If the odds ratio is less than 1, a unit increase in age decreases the odds of the event occurring.⁶

5 Weighting formula can be found at http://www.cdc.gov/brfss/technical_infodata/weighting.htm

6 Further information about the odds ratios can be found at <http://www2.chass.ncsu.edu/garson/pa765/logit.htm>

5. Results

The descriptive statistics with the definitions of variables are found in Table1. 85.1% of the respondents that fit the inclusion criteria, have some kind of health insurance coverage. The respondents who report having insurance are more likely to be wage-earners. Similarly, individuals who report excellent,very good or good health statuses (labelled as Healthy people) are more likely to have insurance. Individuals who report having a health insurance on average are found to be older than people reporting not having a health insurance. The highest difference between health insurance statuses are found for physician visits for routine check up: 65.5% of the insured people visited physician during last year whereas only 38% of the uninsured people visited physician for a routine check up. Among the survey population, males, smokers, obese people and people who do not exercise are less likely to have health insurance. Moreover, black people and Hispanics are less likely to have insurance. People with high income and higher education are more likely to report having health insurance. In addition, married people are found more likely to report having health insurance, whereas divorced people are found less likely to have health insurance, probably as a result of spouse-based insurance benefits. Finally people who are not satisfied with their lives are less likely to have insurance.

Table1 Definitions, means, and standard deviations of variables

Variable	Definition	All	With Insurance	Without Insurance
Insurance	Dichotomous variable that equals 1 if respondent has some form of health insurance coverage	0.851 (0.00261)		
Smoking	Dichotomous variable that equals 1 if respondent smokes every day or some days	0.205 (0.00255)	0.181 (0.00248)	0.345 (0.00927)
Obesity	Dichotomous variable that equals 1 if Body Mass Index of respondent is equal to or greater than 30	0.242 (0.00255)	0.242 (0.00263)	0.246 (0.00812)
Exercise	Dichotomous variable that equals 1 if respondent participates in any physical activities other than regular job	0.820 (0.00243)	0.838 (0.00237)	0.716 (0.00888)
Employment	Dichotomous variable that equals 1 if respondent works as a wage-earner.	0.869 (0.00205)	0.888 (0.00189)	0.765 (0.00819)
Age	Age of respondent	39.95 (0.0769)	40.75 (0.0775)	35.35 (0.229)
Number of Children	Total number of children under 18 living in the house	1.007 (0.00715)	1.002 (0.00734)	1.036 (0.0233)
Male	Dichotomous variable that equals 1 if respondent is male	0.571 (0.00291)	0.559 (0.00305)	0.638 (0.00856)
Black non-Hispanic	Dichotomous variable that equals 1 if respondent is Black but not Hispanic	0.0926 (0.00161)	0.0883 (0.00170)	0.117 (0.00494)
Other Races non-Hispanic	Dichotomous variable that equals 1 if respondent is non Hispanic and other than White or Black	0.0507 (0.00150)	0.0514 (0.00162)	0.0464 (0.00395)
Hispanic	Dichotomous variable that equals 1 if respondent is Hispanic	0.144 (0.00290)	0.108 (0.00264)	0.351 (0.0108)
Physician visit	Dichotomous variable that equals 1 if respondent visited a physician during last 12 months for a routine check up	0.614 (0.00306)	0.655 (0.00306)	0.380 (0.00913)
Income15_25	Dichotomous variable that equals 1 if the annual income of respondent is higher than 15000\$ less than 25000\$	0.109 (0.00225)	0.0729 (0.00192)	0.316 (0.00939)
Income25_35	Dichotomous variable that equals 1 if the annual income of respondent is higher than 25000\$ less than 35000\$	0.108 (0.00202)	0.0920 (0.00186)	0.200 (0.00812)
Income35_50	Dichotomous variable that equals 1 if the annual income of respondent is higher than 35000\$ less than 50000\$	0.157 (0.00214)	0.160 (0.00227)	0.142 (0.00611)
Income50_	Dichotomous variable that equals 1 if the annual income of respondent is higher than 50000\$	0.583 (0.00307)	0.653 (0.00307)	0.184 (0.00684)
High School	Dichotomous variable that equals 1 if respondent completed exactly 12 years of formal schooling	0.255 (0.00265)	0.236 (0.00267)	0.362 (0.00918)
Some College	Dichotomous variable that equals 1 if respondent completed at least 13 years but fewer than 16 years of formal schooling	0.263 (0.00264)	0.267 (0.00278)	0.241 (0.00789)
College	Dichotomous variable that equals 1 if respondent graduated from college	0.406 (0.00291)	0.450 (0.00309)	0.159 (0.00681)
Married	Dichotomous variable that equals 1 if respondent is married	0.658 (0.00300)	0.698 (0.00298)	0.429 (0.00972)
Divorced	Dichotomous variable that equals 1 if respondent is divorced or separated	0.108 (0.00162)	0.100 (0.00159)	0.153 (0.00602)
Not Satisfied with life	Dichotomous variable that equals 1 if respondent is dissatisfied or very dissatisfied with life	0.271 (0.000938)	0.0215 (0.000857)	0.0586 (0.00395)
Healthy people	Dichotomous variable that equals 1 if respondent reports Excellent, Very Good or Good Health	0.927 (0.00175)	0.946 (0.00151)	0.8373 (0.00705)

*Standard deviations are in paranthesis. BRFSS sampling weights are used in calculating the means.

Table2 Binary Logistic Regression results for Smoking, Obesity, and Exercise (Age group 18-64)

	Smoking	Smoking (IV)	Obesity	Obesity (IV)	Exercise	Exercise (IV)
Insurance	0.712*** (0.644 - 0.787)	1.001 [<i>p</i> =0.974] (0.929 - 1.079)	1.101* [<i>p</i> =0.060] (0.996 - 1.218)	1.181*** (1.110 - 1.258)	1.208*** (1.083 - 1.346)	0.856*** (0.798 - 0.919)
Healthy	0.710*** (0.622 - 0.812)	0.704*** (0.615 - 0.807)	0.545*** (0.484 - 0.615)	0.524*** (0.464 - 0.592)	1.535*** (1.348 - 1.747)	1.607*** (1.409 - 1.832)
Age	0.992*** (0.989 - 0.996)	0.992*** (0.988 - 0.995)	1.016*** (1.013 - 1.019)	1.013*** (1.010 - 1.016)	0.982*** (0.979 - 0.985)	0.985*** (0.982 - 0.989)
No of Children	0.970** (0.941 - 0.999)	0.970** (0.941 - 1.000)	1.060*** (1.034 - 1.088)	1.050*** (1.023 - 1.077)	0.970* (0.940 - 1.001)	0.981 (0.951 - 1.013)
Physician visit	0.772*** (0.722 - 0.824)	0.738*** (0.667 - 0.816)	1.197*** (1.126 - 1.273)	1.021 (0.934 - 1.117)	1.101*** (1.025 - 1.183)	1.321*** (1.191 - 1.464)
Male	1.188*** (1.119 - 1.261)	1.194*** (1.124 - 1.269)	1.239*** (1.172 - 1.309)	1.272*** (1.203 - 1.346)	1.197*** (1.124 - 1.275)	1.162*** (1.090 - 1.240)
Black	0.646*** (0.583 - 0.715)	0.653*** (0.588 - 0.725)	1.978*** (1.811 - 2.160)	2.091*** (1.910 - 2.289)	0.592*** (0.540 - 0.650)	0.560*** (0.508 - 0.616)
Other_race	0.945 (0.810 - 1.103)	0.946 (0.808 - 1.107)	0.559*** (0.483 - 0.646)	0.585*** (0.505 - 0.677)	0.603*** (0.515 - 0.706)	0.575*** (0.491 - 0.674)
Hispanic	0.418*** (0.363 - 0.481)	0.436*** (0.378 - 0.504)	1.087 (0.973 - 1.215)	1.217*** (1.080 - 1.372)	0.647*** (0.579 - 0.724)	0.566*** (0.499 - 0.641)
High School	0.725*** (0.623 - 0.844)	0.706*** (0.605 - 0.823)	1.061 (0.916 - 1.229)	1.008 (0.869 - 1.171)	1.277*** (1.108 - 1.471)	1.367*** (1.183 - 1.579)
Some College	0.506*** (0.432 - 0.593)	0.488*** (0.412 - 0.578)	1.116 (0.961 - 1.296)	1.019 (0.873 - 1.191)	1.923*** (1.659 - 2.230)	2.162*** (1.850 - 2.526)
College	0.233*** (0.198 - 0.275)	0.223*** (0.185 - 0.269)	0.714*** (0.613 - 0.830)	0.610*** (0.517 - 0.722)	2.886*** (2.466 - 3.377)	3.455*** (2.902 - 4.114)
Income15_25	1.159 (0.956 - 1.404)	1.132 (0.932 - 1.375)	1.038 (0.857 - 1.257)	1.002 (0.827 - 1.214)	1.097 (0.909 - 1.324)	1.162 (0.962 - 1.404)
Income25_35	1.151 (0.951 - 1.393)	1.087 (0.892 - 1.325)	1.025 (0.849 - 1.239)	0.922 (0.758 - 1.120)	1.243** (1.020 - 1.514)	1.449*** (1.184 - 1.773)
Income35_50	1.102 (0.916 - 1.326)	1.002 (0.809 - 1.242)	0.987 (0.821 - 1.186)	0.799** (0.650 - 0.983)	1.225** (1.015 - 1.478)	1.617*** (1.306 - 2.002)
Income50_	0.853* (0.710 - 1.026)	0.766** (0.596 - 0.985)	0.883 (0.737 - 1.059)	0.626*** (0.496 - 0.789)	1.798*** (1.492 - 2.167)	2.728*** (2.135 - 3.484)
Married	0.673*** (0.614 - 0.738)	0.657*** (0.598 - 0.723)	1.168*** (1.074 - 1.270)	1.089* (0.997 - 1.189)	0.944 (0.854 - 1.043)	1.019 (0.918 - 1.130)
Divorced	1.313*** (1.181 - 1.459)	1.301*** (1.171 - 1.447)	0.986 (0.893 - 1.089)	0.988 (0.895 - 1.091)	1.011 (0.903 - 1.133)	1.010 (0.902 - 1.131)
Not satisfied w/ life	1.869*** (1.602 - 2.182)	1.970*** (1.667 - 2.328)	0.954 (0.819 - 1.111)	1.004 (0.862 - 1.171)	0.811** (0.687 - 0.957)	0.759*** (0.642 - 0.897)
t-test for instrument weakness		(21.72) p<0.001		(21.72) p<0.001		(21.72) p<0.001
Hausman test		(1.54) p >0.10%		(2.10) p <0.05%		(3.38) p <0.01%
Observations (N)	134415	134534	130250	130367	134669	134790

Odds ratios are reported in the table. 95% confidence intervals in parentheses, p values for some of the variables are in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. t-test and Hausman test reports the t statistics and significance levels.

Table 2 presents logistic regression estimates of smoking, obesity and exercise both with and without instrumental variable approach. The abbreviation (IV) refers to the estimates after instrumenting for insurance. Having a health insurance decreases the odds of smoking (OR:0.71 [95%CI 0.64-0.79], $p<1\%$) disregarding the endogeneity of insurance. However, after instrumenting, impact of insurance loses statistical significance, so it can be said that people who have health insurance are equally likely to smoke as do uninsured people according to this model. Initially, for obesity, insurance receipt is associated with an increase in the odds of being obese, whereas after instrumenting, existence of insurance becomes more effective on the odds of being obese (OR:1.18 [95%CI 1.11-1.26], $p<1\%$). Without instrumental variable, having a health insurance increases the odds of exercise (OR:1.21 [95% CI 1.08-1.35], $p<1\%$), whereas it decreases the odds of exercising (OR:0.86[95%CI 0.80-0.92], $p<1\%$) after instrumenting for insurance. T-test results show that the selected instrument is far from being weak since t statistics is well above 10 which is used as a rule of thumb to test instrument weakness (Stock&Watson 2003, p.350). Hausman test rejects the exogeneity of insurance, except for smoking model, indicating the reverse causality problem in obesity and exercise models⁷.

Assuming the instrument is valid, according to the results, people who have health insurance are 18% more likely to be obese, and 14% less likely to engage in physical activity than do uninsured people. Since insurance is not associated with the odds of smoking, it can be said that insured people are as equally likely to smoke as uninsured people.

As for the control variables, before and after instrumenting does not show substantial differences. According to the instrumented models, good or better healthy people have smaller likelihood of engaging in risky behaviours compared to less healthy people. A unit increase in age is associated with a slight decrease in the odds of smoking, exercising, but a slight increase in the odds of being obese. Similarly, the impact of an increase in the number of children living in the household slightly decreases the odds of smoking, exercising, but increases the odds of being obese. The physician visit seem to have positive and significant effect on good health behaviours, so that people who have seen a physician during the last year have a smaller likelihood of smoking compared to people who have not seen a physician during the last year. In addition, they also have a higher likelihood of exercising than people who have not seen a physician. However, physician visit

⁷ Since there is only one instrument in the model, there is not a perfect way to measure the validity of the selected instrument, hence the validity of the instrument is to be relied on t-tests throughout the thesis.

is associated with an increase in the likelihood of being obese when the endogeneity of insurance is neglected, whereas it seems independent of obesity after instrumenting. In other words, people who have seen a physician during last year are equally likely to be obese as people who have not seen a physician. Males have relatively higher likelihood of smoking, obesity and exercising than females.

Among the race/ethnicity groups, compared to non Hispanic whites, all members of race minorities are less likely to exercise. Moreover, non Hispanic Black people are less likely to smoke but more likely to be obese whereas members of other minority races are less likely to be obese compared to non Hispanic Whites. As being an ethnic minority, Hispanics have smaller likelihood of smoking, exercising, but a higher likelihood of being obese compared to non Hispanics.

Although, some of the levels are not significant for income and education variables in the regressions, in overall, increase in the level of both annual household income and education levels decreases the odds of smoking and obesity, but increases the odds of exercising. In other words, high income earners and more educated people are more likely to have healthier lifestyles.

The significant marital status odds ratios also indicate that being married increases the odds of being obese but decreases the odds of smoking however, it does not have a significant impact on exercise. Per contra, being divorced increases the odds of smoking. Finally, being dissatisfied with life significantly increases the odds of smoking and decreases the odds of exercising, but does not have a significant impact on obesity. To conclude, the model captures ex-ante moral hazard effect of insurance on obesity and exercise after using an instrumental variable, however the impact on smoking is not significant.

6. Sensitivity Analysis

The above models elaborate the impact of health insurance on health behaviors by using the whole working population age interval(18-65). However, this range can be considered very large in the sense that it may give room for heterogeneity among the individuals. Even though instrumental variable technique is employed to eliminate heterogeneity among individuals which can jointly determine the health insurance status and health behaviors, it is also possible to restrict sample so as to reduce the potential heterogeneity among individuals in advance. For example, Rashad&Markowitz(2007) restrict the sample size up to 55 years due to the reason that people between 55-64 years can change their incentives in health behaviors and insurance status probably

Table3 Binary Logistic Regression results for Smoking, Obesity, and Exercise (Age group 18-55)

	Smoking	Smoking (IV)	Obesity	Obesity (IV)	Exercise	Exercise (IV)
Insurance	0.705*** (0.634 - 0.784)	0.989 [<i>p</i> =0.798] (0.912 - 1.074)	1.103* [<i>p</i> =0.075] (0.990 - 1.228)	1.194*** (1.112 - 1.281)	1.173*** (1.043 - 1.318)	0.852*** (0.787 - 0.923)
Healthy	0.697*** (0.603 - 0.807)	0.693*** (0.597 - 0.805)	0.545*** (0.476 - 0.623)	0.519*** (0.452 - 0.595)	1.551*** (1.342 - 1.792)	1.639*** (1.414 - 1.899)
Age	0.999 (0.995 - 1.003)	0.998 (0.994 - 1.002)	1.021*** (1.018 - 1.025)	1.018*** (1.014 - 1.022)	0.983*** (0.979 - 0.987)	0.987*** (0.982 - 0.991)
No of Children	0.964** (0.935 - 0.995)	0.965** (0.936 - 0.996)	1.049*** (1.022 - 1.077)	1.038*** (1.011 - 1.066)	0.970* (0.939 - 1.001)	0.981 (0.949 - 1.013)
Physician visit	0.787*** (0.733 - 0.844)	0.760*** (0.681 - 0.848)	1.181*** (1.106 - 1.261)	0.994 (0.900 - 1.099)	1.108*** (1.025 - 1.198)	1.334*** (1.189 - 1.497)
Male	1.172*** (1.099 - 1.250)	1.175*** (1.101 - 1.254)	1.244*** (1.172 - 1.321)	1.275*** (1.200 - 1.355)	1.240*** (1.157 - 1.329)	1.208*** (1.126 - 1.296)
Black	0.611*** (0.548 - 0.680)	0.615*** (0.550 - 0.688)	2.011*** (1.830 - 2.210)	2.139*** (1.940 - 2.358)	0.589*** (0.533 - 0.651)	0.555*** (0.500 - 0.616)
Other_race	0.920 (0.782 - 1.083)	0.918 (0.778 - 1.083)	0.553*** (0.474 - 0.644)	0.580*** (0.497 - 0.677)	0.592*** (0.501 - 0.699)	0.565*** (0.477 - 0.668)
Hispanic	0.409*** (0.353 - 0.473)	0.424*** (0.364 - 0.493)	1.095 (0.974 - 1.230)	1.244*** (1.095 - 1.414)	0.640*** (0.568 - 0.720)	0.554*** (0.484 - 0.635)
High School	0.710*** (0.604 - 0.835)	0.694*** (0.589 - 0.818)	1.059 (0.904 - 1.240)	1.005 (0.856 - 1.181)	1.262*** (1.083 - 1.472)	1.345*** (1.151 - 1.573)
Some College	0.492*** (0.415 - 0.583)	0.478*** (0.399 - 0.573)	1.115 (0.949 - 1.310)	1.015 (0.858 - 1.201)	1.922*** (1.638 - 2.257)	2.151*** (1.816 - 2.548)
College	0.221*** (0.186 - 0.263)	0.213*** (0.174 - 0.261)	0.703*** (0.597 - 0.827)	0.594*** (0.495 - 0.713)	2.844*** (2.397 - 3.375)	3.415*** (2.820 - 4.135)
Income15_25	1.144 (0.934 - 1.403)	1.123 (0.915 - 1.379)	1.042 (0.851 - 1.277)	1.008 (0.822 - 1.235)	1.104 (0.905 - 1.346)	1.162 (0.952 - 1.418)
Income25_35	1.133 (0.925 - 1.387)	1.081 (0.877 - 1.333)	0.993 (0.812 - 1.214)	0.893 (0.726 - 1.099)	1.250** (1.013 - 1.541)	1.439*** (1.162 - 1.782)
Income35_50	1.062 (0.873 - 1.291)	0.982 (0.783 - 1.232)	0.965 (0.793 - 1.174)	0.776** (0.623 - 0.968)	1.266** (1.037 - 1.545)	1.655*** (1.319 - 2.078)
Income50_	0.825* (0.679 - 1.002)	0.760** (0.582 - 0.993)	0.855 (0.705 - 1.037)	0.598*** (0.466 - 0.767)	1.881*** (1.543 - 2.293)	2.825*** (2.173 - 3.672)
Married	0.656*** (0.595 - 0.723)	0.643*** (0.581 - 0.712)	1.153*** (1.054 - 1.261)	1.067 (0.970 - 1.173)	0.927 (0.831 - 1.034)	1.004 (0.896 - 1.126)
Divorced	1.256*** (1.120 - 1.410)	1.246*** (1.110 - 1.399)	0.942 (0.845 - 1.050)	0.948 (0.851 - 1.057)	1.007 (0.888 - 1.142)	1.000 (0.882 - 1.134)
Not satisfied w/life	1.919*** (1.628 - 2.261)	2.021*** (1.692 - 2.415)	0.923 (0.784 - 1.087)	0.980 (0.831 - 1.155)	0.837* (0.699 - 1.002)	0.780*** (0.650 - 0.935)
t-test for instrument		(23.11) p<0.001		(23.11) p<0.001		(23.11) p<0.001
Hausman test		1.43 p >0.10		2.50 p <0.05		3.11 p <0.01
Observations	112310	112417	108739	108845	112516	112625

Odds ratios are reported in the table. 95% confidence intervals in parentheses, p values for some of the variables are in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. t-test and Hausman test reports the t statistics and significance levels.

due to the anticipation of Medicare benefit. In accordance with this argument, the same model is applied to a sample which contains individuals between the ages of 18 and 55 who are either self employed or wage earners, as an attempt to get rid of potential heterogeneity among individuals in their incentives and make more sensitive analysis with more reliable inferences.

Table3 shows the logistic regression results by using the same model with the restricted sample. When compared to the first sample, the results do not show dramatic changes. Before instrumenting, having a health insurance decreases the likelihood of smoking, however, after instrumenting the impact of insurance loses significance. Again, it can be said that the likelihood of smoking is independent of having a health insurance. For obesity, in line with the first analysis, having a health insurance becomes more effective after instrumenting so that insured people have 19.4% higher likelihood of being obese than uninsured people(OR:1.19[95%CI 1.11-1.28] $p<1\%$). The impact of insurance changes its direction after instrumenting for exercise as the same as in the first analysis that after instrumenting, insured people are found approximately 15% less likely to exercise compared to uninsured people(OR:0.85[95%CI 0.79-0.92] $p<1\%$).

Similarly good or better healthy people are more likely to have good health behaviors compared to less healthy people. A unit increase in age increases the likelihood of being obese and decreases the likelihood of exercising, whereas does not have any impact on the likelihood of smoking. Like in the first analysis, a unit increase in the number of children under 18 years living in the household is associated with an increase in the odds of being obese, but a decrease in the odds of smoking, whereas the impact loses significance on the odds of exercise after instrumenting.

Physician visit seem to have positive effect on inducing people to engage in healthy behaviors so that having seen a physician during the last year decreases the likelihood of smoking, and increases the likelihood of exercising. However, similar to the previous analysis, its impact can not yield in statistical significance, therefore it can be said that the likelihood of being obese is independent of physician visits.

Males have relatively higher likelihood of smoking, obesity and exercising than females. Non Hispanic Black people are found to be less likely to smoke however more likely to be obese

than non Hispanic White people. When compared to non Hispanic White people, all members of other race groups have smaller likelihood of exercising. Hispanics are less likely to smoke and exercise whereas they are more likely to be obese when compared to non Hispanics. Education levels indicate that as the level increases the impact on the likelihoods of healthy behaviors increase. However, for obesity, only college graduates are less likely to be obese compared to people who receive less than 12 years of education. Compared to annual income of 15.000\$, only having an income higher than 50.000\$ has significant impact on the likelihood of each of the health behaviors. Compared to very low income earners, people who have above 50.000\$ are less likely to smoke and be obese and more likely to exercise. Marital status variables only have effects on the odds of smoking, such that married people have smaller likelihood of smoking whereas divorced people, on the contrary have higher odds of smoking. Finally, again in line with the first analysis, people who are not satisfied with their lives are found to be more likely to smoke, and less likely to exercise, however, individuals are found equally likely to be obese even if they differ in overall satisfaction with their lives.

7. Discussion

The findings above give empirical evidence for ex-ante moral hazard; effect of insurance not on smoking but on both obesity and exercise. After instrumenting, the impact of insurance on smoking becomes insignificant implying that people are equally likely to smoke even if they differ in their insurance statuses.

On the contrary, results for obesity and exercise indicate that people who have insurance are more likely to be obese and less likely to engage in physical activity. The results are consistent for both samples.

Although, obesity in the U.S. has been a major problem over 30 years, until 2004, obesity was not even considered as an epidemic by Medicare. However, in the last few years, the obesity problem in the U.S. has been receiving intensive attention and there have been strenuous activities at the national level. Especially, many state health insurance providers started supporting bariatric surgeries⁸ considering both their benefits to the patient and their cost-effectiveness (Appleby 2006).

⁸Bariatric surgery is a surgery on the stomach and/or intestines to help a person with extreme obesity lose weight. Bariatric surgery is an option for people who have a body mass index (BMI) above 40. Surgery is also an option for

Moreover, bariatric surgeries are the only clinically proven methods of losing weight and gaining weight control in the long run and they are the most recommended technique for the treatment of clinically severe obesity. Furthermore, it is also found that after these surgeries, there are significant improvements in the health statuses and chronic disease prevalence of individuals who had those diseases as a result of being obese (ASMBS Rationale for surgery).

However, although people expected the private insurance companies to support these surgeries in line with public health insurance providers, the companies' reaction was on the contrary, rather restrictive. In fact, since early 2000s, many insurers have been raising the eligibility criteria for obesity related surgeries, apparently due to dramatic increase in the demand of the insured people for these operations (Turtle 2006). For example, nowadays many insurance companies require documentation of dieting and exercise attempts before authorizing the surgery so as to induce people to engage in prevention so as to make them learn how to keep weights under control while subsequently maintaining their costs under control⁹.

However, according to the results derived from the analysis above, these criteria and precautions imposed by private insurance companies do not seem to have deterrent effect on individuals. It can be argued that people do not conceive obesity as a threat. Besides, in case of a severe obesity problem, they might rely on the prevalence and benefits of the bariatric surgeries which are mostly covered by insurance companies. Concurrently with the technological advances in medical treatments, insured individuals may regard surgery as a “nearly perfect substitute” which is suggested by Kenkel (2000). At this point, it is convenient to bring imperfect information into scene as a potential exacerbating factor of ex-ante moral hazard problem among insured people. If people are not well aware of the risks associated with obesity, they can perceive insurance as capable of compensating the health loss due to obesity and obesity related diseases such as type 2 diabetes, hypertension, stroke entirely by offering the surgeries and this unawareness can render the attempts of private insurance companies in order to make people engage in prevention.

The importance of information asymmetry while explaining the ex-ante moral hazard problem is also evident from the regression results. Unlike the effect of physician counseling on smoking and exercise, physician impact on obesity is not as effective. In accordance with this result, Morrato et al.(2006) shows that obese people with diabetes or with other risk factors are more likely

people with a BMI between 35 and 40 who have health problems like type 2 diabetes or heart disease

⁹ Medical University of South Carolina, Bariatric Surgery

Program:<http://www.muschealth.com/weightlosssurgery/qualifying/insurancecoverage.htm>

to get physician counseling, however odds of getting counseling declines as the risk factors of obese people declines. Similarly, Abid et al.(2005) shows that during recent years, despite upward trend in obesity prevalence, proportions of obese people who get advice from physicians decline. These findings indicate that obesity does not draw the sufficient attention before reaching to serious levels, subsequently exacerbating the ex-ante moral hazard problem.

In addition, the regression results also provide recent information about the disparities among different economic and demographic characteristics and their impacts on health behaviors. For example, in accordance with Grossman model, increased income and education levels leads to better health choices, however, increase in age does not yield a consistent path among healthy behaviors. As number of children under 18 years increases, the odds of smoking and exercising decreases but obesity increases. Males are more likely to smoke, be obese and exercise than women, consistent with the existing literature. The race ethnicity variables indicate that, on average, Hispanics are less likely to smoke and exercise but more likely to be obese compared with non Hispanics. Black non Hispanics are less likely to smoke and exercise but more likely to be obese compared to White Americans. Unsurprisingly, being not satisfied with life decreases the odds of engaging good health behaviors, except for obesity where the effect is not significant. Among marital statuses, married people are found less likely to smoke and exercise but more likely to be obese whereas divorced people are more likely to smoke.

However, in spite of reasonable and significant results, there are a few limitations of the analyses. Considering the fact that the data used in the analysis is a cross-sectional survey, and the model cannot assess the temporal relation between health behaviours and insurance receipt, thus the causal relations and the interpretations are to be restricted to the assumption that “employment status” is a valid instrument and handles both the reverse causality and the omitted variables bias. Since the essence of the study is to analyse the behavioural implications of insurance, it is more relevant to pursue the same analysis with a longitudinal survey in order to make more reliable inferences. Another limitation is that the data does not contain information about the insurance coverage rates which the individuals have. Due to the fact that ex ante moral hazard is closely related to the compensation rate of insurance, it would be useful to include coverage rates rather than to use the presence of insurance. Alternatively, since the firm size is an indicator of insurance coverage, having information about firm size of the individuals can also help to improve the quality of the model since the size of the ex-ante moral hazard problem depends on the insurance coverage and using firm size as an instrument instead of “employment status” might enable to make more

realistic inferences.

8. Conclusion

In this study, ex-ante moral hazard effect of insurance on primary prevention is investigated. The hypothesis is that people who have health insurance are less likely to engage in prevention compared to uninsured people since insurance receipt decreases the monetary costs of medical care. Due to potential endogeneity of insurance, instrumental variable technique is pursued in order to get unbiased estimates and make more reliable inferences. The selected instrument, employment status is believed to have high correlation with the insurance status but not to have a correlation with health behaviours. For the regression analysis, the Behavioral Risk Factor Surveillance System (BRFSS) 2006 is used.

It is found that insurance receipt has no impact on the odds of smoking. However, ex- ante moral hazard effect is found on obesity and exercise among both samples. That is, people who have health insurance are less likely to engage in physical activity and more likely to be obese. It is reasonable to take “lack of information” as a exacerbating factor of ex-ate moral hazard. Since people are not well informed about the risks of obesity, the insurance receipt can be conceived to tackle all probable losses due to obesity and lack of exercise. Moreover, without creating awareness at the national level, tightening the eligibility criteria for surgeries cannot also be accepted as an encouragement of people to have healthier lifestyles.

The implications of this thesis' findings are in accordance with the current agenda of U.S that physical activity and obesity should be prioritized among the preventive behaviours and intensive public awareness needs to be created in order to improve the quality of lives of patients while keeping the health care expenditures under control. However, for further policy implications, more detailed analysis needs to be made. Future research therefore requires the replication of the model using a panel survey data in order to assess the temporal sequence of insurance and preventive health behaviours.

References

- Abid, A. Galuska, D., Khan, L.K., Gillespie, C., Ford, E.S., & Serdula, M.K (2005), "Are healthcare professionals advising obese patients to lose weight? A trend analysis." *Medscape General Medicine*, 7(4): 10.
- American Society for Metabolic& Bariatric Surgery 2005, *Rationale for the surgical treatment of morbid obesity, 2005*, Available [online]:
http://www.asbs.org/Newsite07/patients/resources/asbs_rationale.htm
- Appleby J. "Medicare to Cover Surgery to Treat Obesity," *USA Today*, 22 February 2006.
- Centers for Disease Control and Prevention (CDC) 2007, *Overweight and Obesity; Economic Consequences*, Available [online]:
http://www.cdc.gov/nccdphp/dnpa/obesity/economic_consequences.htm
- Centers for Disease Control and Prevention(CDC), *Sustaining State Programs for Tobacco Control Data Highlights, 2006* Available[online]:
http://www.cdc.gov/tobacco/data_statistics/state_data/data_highlights/2006/index.htm
- Cook, P.J., & Graham, D. (1977), "The demand for insurance and protection: The case of irreplaceable commodities." *Quarterly Journal of Economics*, 91(1):143-156.
- Courbage, C., & de Coulon, A. (2004), "Prevention and Private Health Insurance in the U.K." *Geneva Papers on Risk and Insurance*, 29(4): 719-727.
- Dave, D. & Kaestner, R. (2006), "Health Insurance and Ex Ante Moral Hazard: Evidence from Medicare." *NBER Working Paper No. 12764*.
- Ehrlich, I. & Becker, G. (1972), "Market Insurance, Self-Insurance and Self-Protection." *Journal of Political Economy*, 80(4): 623-648.
- Folland, S., Goodman, A. C., & Stano, M., (2007), "The Economics of Health and Health Care." Pearson Education: New Jersey.

- Garson, G. D.,(2008), “Log-Linear, Logit, and Probit Models” lecture notes in the topic PA765 Multivariate Analysis in Public Administration. North Carolina University, Available [online]: <http://www2.chass.ncsu.edu/garson/pa765/logit.htm>
- Grossman, M. (1972), “On the concept of health capital and the demand for health.” *Journal of Political Economy*. 80(2): 223-255.
- Gujarati, D. N., (2003), “Basic Econometrics.” United States Military Academy, West Point, McGraw Hill: New York.
- Holtz-Eakin, D., Penrod, J., & Rosen, H. S. (1994), “Health Insurance and the Supply of Entrepreneurs.” *Journal of Public Economics*, 62 :209-235.
- Jha, P., Ranson, M. K., Nyugen, S. N., Yach, D. (2002), “Estimates of Global and Regional Smoking Prevailance in 1995, by Age and Sex.” *Am J Public Health*, 92(6): 1002–1006.
- Kaise Family Foundation 2007, *Employer Health Benefits 2007 Annual Survey*, Available [online]: <http://www.kff.org/insurance/7672/index.cfm>
- Kaiser Family Foundation 2007, *Medicare: a Primer , 2007*, Available [online]: <http://www.kff.org/medicare/7615.cfm>
- Kaiser Family Foundation 2008, *Medicaid's role for People with Disabilities*, Available [online]: <http://www.kff.org/medicaid/7732a.cfm>
- Kenkel, D.S. (2000), “ Prevention.” In: A.J. Culyer and J. P. Newhouse, editors, *Handbook of Health Economics*, Volume 1B. Elsevier: The Netherlands.
- Komlos, J., Smith, P., & Bogin, B. (2004), “Obesity and the Rate of Time Preference: Is There A Connection?” *Journal of Biosocial Science*, 36(2): 209-219
- Louie, A., J. (1997), “The Role of Cognitive Dissonance in Decision Making.” Unpublished.
- Medical University of South Carolina, Bariatric Surgery Program, Available [online]:

<http://www.muschealth.com/weightlosssurgery/qualifying/insurancecoverage.htm>

Meer, J. & Rosen, H. S. (2004), "Insurance and the Utilization of Medical Services." *Social Science and Medicine*, 58:1623-1632.

Morrato, E. H., Hill, J. O., Wyatt, H. R., Ghushchyan, V., Sullivan, M. (2006), "Are Health Care Professionals Advising Patients With Diabetes or At Risk for Developing Diabetes to Exercise More?" *Diabetes Care*, 29:543-548.

Perry, C. W. & Rosen, H. S. (2001a), "The self employed are less likely to have insurance than wage earners. So what?" *NBER Working Paper No.8316*.

Perry, C. W. & Rosen, H. S. (2001b), "Insurance and the utilization of medical services among the self employed." *NBER Working Paper No.8490*.

Rashad, I. & Markowitz, S. (2007), "Incentives in Obesity and Health Insurance." *NBER Working Paper No.13113*.

Stanciole, A. (2007), "Health Insurance and Life Style Choices: Identifying the Ex Ante Moral Hazard." *IRISS Working Paper, 2007-10*, CEPS/INSTEAD, Differdange, Luxembourg

Stock, J., & Watson, M., (2003), "Introduction to Econometrics." Addison Wesley: US.

Tuttle, D.J. "Reluctant insurers shy away from weight-loss surgery coverage," *San Antonio Business Journal*, 27 November 2006.

Ylöstalo, P. V., Ek, E., Laitinen, J., & Knuuttila, M. L. (2003), "Optimism and Life Satisfaction as Determinants for Dental and General Health behavior- Oral Health Habits Linked to Cardiovascular Risk Factors." *Journal of Dental Research*, 82(3): 194-199.

Zweifel, P. & Manning, W.G. (2000), "Moral Hazard and Consumer Incentives in Health Care." In Culyer, A.J. & J.P. Newhouse (eds.), *Handbook of Health Economics*, Elsevier: Amsterdam, London, New York, Oxford, Shannon, Tokyo, 409-459.

Appendix

APPENDIX 1A: First Stage (Reduced form) of the 2 stage binary logistic regression

	Age group (18-65)	Age group (18-55)
	Insurance	Insurance
Employment	1.347*** (21.72)	1.389*** (23.11)
Healthy	0.327*** (3.71)	0.025*** (9.20)
Age	0.024*** (10.34)	0.073*** (3.33)
No of Children	0.072*** (3.31)	1.020*** (20.36)
Physician visit	0.978*** (20.39)	-0.085* (1.80)
Male	-0.117*** (2.58)	-0.370*** (5.53)
Black	-0.360*** (5.80)	-0.328*** (2.68)
Other_race	-0.311*** (2.81)	-0.793*** (10.70)
Hispanic	-0.762*** (10.98)	0.401*** (4.23)
High School	0.374*** (4.38)	0.677*** (7.07)
Some College	0.636*** (7.38)	1.109*** (10.70)
College	1.048*** (11.04)	0.097 (0.89)
Income15_25	0.210** (2.12)	0.544*** (4.94)
Income25_35	0.691*** (6.86)	1.251*** (11.27)
Income35_50	1.364*** (13.56)	2.107*** (18.71)
Income50_	2.191*** (21.13)	0.472*** (7.14)
Married	0.453*** (7.16)	-0.069 (1.00)
Divorced	-0.030 (0.46)	-0.425*** (4.47)
Not satisfied with life	-0.347*** (3.55)	-2.692*** (15.85)
N	134717	112552

t statistics in paranthesis. * significant at 10%; ** significant at 5%; *** significant at 1%. Constant is not reported.

APPENDIX 2A: Generalized Ordered Logit Estimates of Smoking (age group 18-65)

From Non Smoker to Occasional Smoker From Occasional to Daily Smoker

	Before Instrumenting	After Instrumenting	Before Instrumenting	After Instrumenting
Insurance	0.707*** [0.641,0.780]	1.000 <i>p=0.990</i> [0.930,1.076]	0.707*** [0.641,0.780]	1.044 <i>p=0.250</i> [0.970,1.124]
Healthy	0.710*** [0.624,0.809]	0.703*** [0.616,0.802]	0.710*** [0.624,0.809]	0.703*** [0.616,0.802]
Age	0.992*** [0.989,0.995]	0.992*** [0.988,0.995]	0.998 [0.994,1.001]	0.996* [0.992,0.999]
No of Children	0.967* [0.938,0.996]	0.970* [0.941,1.000]	0.983 [0.952,1.015]	0.970* [0.941,1.000]
Physician visit	0.770*** [0.721,0.822]	0.736*** [0.666,0.813]	0.722*** [0.673,0.773]	0.658*** [0.592,0.731]
Male	1.185*** [1.116,1.258]	1.183*** [1.114,1.257]	1.147*** [1.074,1.224]	1.183*** [1.114,1.257]
Black	0.647*** [0.585,0.716]	0.651*** [0.587,0.723]	0.533*** [0.474,0.598]	0.554*** [0.492,0.624]
Other_race	0.949 [0.813,1.109]	0.931 [0.795,1.090]	0.842 [0.701,1.011]	0.931 [0.795,1.090]
Hispanic	0.414*** [0.359,0.477]	0.428*** [0.370,0.496]	0.236*** [0.197,0.282]	0.257*** [0.213,0.311]
High School	0.719*** [0.619,0.834]	0.695*** [0.598,0.808]	0.719*** [0.619,0.834]	0.695*** [0.598,0.808]
Some College	0.500*** [0.428,0.584]	0.480*** [0.407,0.567]	0.468*** [0.400,0.546]	0.442*** [0.375,0.521]
College	0.231*** [0.197,0.272]	0.219*** [0.183,0.264]	0.189*** [0.160,0.224]	0.173*** [0.143,0.209]
Income15_25	1.149 [0.955,1.382]	1.118 [0.927,1.349]	1.149 [0.955,1.382]	1.118 [0.927,1.349]
Income25_35	1.152 [0.956,1.387]	1.076 [0.887,1.306]	1.152 [0.956,1.387]	1.076 [0.887,1.306]
Income35_50	1.114 [0.929,1.336]	0.995 [0.806,1.228]	1.114 [0.929,1.336]	0.995 [0.806,1.228]
Income50_	0.857 [0.714,1.028]	0.763* [0.596,0.978]	0.857 [0.714,1.028]	0.711** [0.554,0.914]
Married	0.683*** [0.624,0.748]	0.663*** [0.604,0.728]	0.683*** [0.624,0.748]	0.663*** [0.604,0.728]
Divorced	1.338*** [1.200,1.490]	1.324*** [1.188,1.476]	1.338*** [1.200,1.490]	1.324*** [1.188,1.476]
Not satisfied with life	1.897*** [1.627,2.213]	2.016*** [1.703,2.385]	1.897*** [1.627,2.213]	2.016*** [1.703,2.385]
N	134415	134534		

Exponentiated coefficients; 95% confidence intervals in brackets * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

APPENDIX 2B: Generalized Ordered Logit Estimates of Smoking (age group 18-55)

From Non Smoker to Occasional Smoker From Occasional to Daily Smoker

	Before Instrumenting	After Instrumenting	Before Instrumenting	After Instrumenting
Insurance	0.700*** [0.632,0.776]	0.988 [0.912,1.070]	0.700*** [0.632,0.776]	1.032 [0.953,1.118]
Healthy	0.698*** [0.606,0.804]	0.691*** [0.598,0.798]	0.698*** [0.606,0.804]	0.691*** [0.598,0.798]
Age	0.998 [0.994,1.002]	0.998 [0.994,1.002]	1.004 [1.000,1.008]	1.002 [0.998,1.007]
No of Children	0.961* [0.932,0.991]	0.965* [0.936,0.996]	0.978 [0.947,1.011]	0.965* [0.936,0.996]
Physician visit	0.785*** [0.732,0.841]	0.759*** [0.681,0.845]	0.727*** [0.676,0.783]	0.668*** [0.596,0.748]
Male	1.170*** [1.098,1.246]	1.172*** [1.099,1.250]	1.120** [1.045,1.200]	1.123** [1.047,1.205]
Black	0.612*** [0.550,0.682]	0.615*** [0.550,0.687]	0.506*** [0.447,0.572]	0.525*** [0.463,0.596]
Other_race	0.923 [0.785,1.085]	0.904 [0.766,1.067]	0.828 [0.682,1.005]	0.904 [0.766,1.067]
Hispanic	0.404*** [0.348,0.469]	0.416*** [0.356,0.485]	0.228*** [0.189,0.276]	0.249*** [0.204,0.304]
High School	0.704*** [0.601,0.825]	0.683*** [0.582,0.802]	0.704*** [0.601,0.825]	0.683*** [0.582,0.802]
Some College	0.487*** [0.412,0.575]	0.470*** [0.394,0.561]	0.453*** [0.384,0.535]	0.431*** [0.362,0.513]
College	0.219*** [0.184,0.261]	0.210*** [0.173,0.256]	0.178*** [0.149,0.213]	0.164*** [0.134,0.201]
Income15_25	1.134 [0.934,1.378]	1.110 [0.912,1.350]	1.134 [0.934,1.378]	1.110 [0.912,1.350]
Income25_35	1.133 [0.931,1.379]	1.071 [0.875,1.313]	1.133 [0.931,1.379]	1.071 [0.875,1.313]
Income35_50	1.062 [0.878,1.285]	0.978 [0.784,1.221]	1.115 [0.920,1.353]	0.978 [0.784,1.221]
Income50_	0.827 [0.683,1.001]	0.760* [0.585,0.988]	0.827 [0.683,1.001]	0.703** [0.539,0.916]
Married	0.665*** [0.605,0.732]	0.648*** [0.587,0.716]	0.665*** [0.605,0.732]	0.648*** [0.587,0.716]
Divorced	1.280*** [1.137,1.441]	1.268*** [1.125,1.428]	1.280*** [1.137,1.441]	1.268*** [1.125,1.428]
Not satisfied with life	1.954*** [1.660,2.298]	2.075*** [1.736,2.480]	1.954*** [1.660,2.298]	2.075*** [1.736,2.480]
N	112310	112417		

Exponentiated coefficients; 95% confidence intervals in brackets * p<0.05, ** p<0.01, *** p<0.001

APPENDIX 2C: Generalized Ordered Logit Estimates of Weight (age group 18-65)

	From Normal to Overweight		From Overweight to Obese	
	Before Instrumenting	After Instrumenting	Before Instrumenting	After Instrumenting
Insurance	1.122** [1.031,1.221]	1.234*** [1.170,1.301]	1.122** [1.031,1.221]	1.157*** [1.097,1.219]
Healthy	0.622*** [0.540,0.717]	0.554*** [0.495,0.621]	0.539*** [0.478,0.607]	0.554*** [0.495,0.621]
Age	1.025*** [1.022,1.027]	1.021*** [1.018,1.024]	1.016*** [1.013,1.018]	1.013*** [1.010,1.016]
No of Children	1.072*** [1.050,1.095]	1.062*** [1.040,1.086]	1.072*** [1.050,1.095]	1.062*** [1.040,1.086]
Physician visit	1.171*** [1.115,1.230]	0.943 [0.871,1.020]	1.171*** [1.115,1.230]	1.042 [0.960,1.130]
Male	2.445*** [2.321,2.576]	2.517*** [2.388,2.654]	1.254*** [1.187,1.325]	1.289*** [1.219,1.363]
Black	1.975*** [1.822,2.140]	2.088*** [1.924,2.267]	1.975*** [1.822,2.140]	2.088*** [1.924,2.267]
Other_race	0.609*** [0.545,0.681]	0.639*** [0.571,0.715]	0.609*** [0.545,0.681]	0.639*** [0.571,0.715]
Hispanic	1.129* [1.029,1.239]	1.276*** [1.157,1.408]	1.129* [1.029,1.239]	1.276*** [1.157,1.408]
High School	1.102 [0.967,1.255]	1.048 [0.919,1.195]	1.102 [0.967,1.255]	1.048 [0.919,1.195]
Some College	1.153* [1.011,1.315]	1.052 [0.919,1.205]	1.153* [1.011,1.315]	1.052 [0.919,1.205]
College	0.765*** [0.672,0.872]	0.647*** [0.562,0.746]	0.765*** [0.672,0.872]	0.647*** [0.562,0.746]
Income15_25	1.074 [0.899,1.283]	1.030 [0.864,1.228]	1.074 [0.899,1.283]	1.030 [0.864,1.228]
Income25_35	1.099 [0.924,1.308]	0.979 [0.821,1.168]	1.099 [0.924,1.308]	0.979 [0.821,1.168]
Income35_50	1.058 [0.894,1.252]	0.842 [0.701,1.012]	1.058 [0.894,1.252]	0.842 [0.701,1.012]
Income50_	1.062 [0.898,1.257]	0.691*** [0.564,0.848]	0.928 [0.783,1.100]	0.691*** [0.564,0.848]
Married	1.227*** [1.143,1.316]	1.130*** [1.051,1.215]	1.227*** [1.143,1.316]	1.130*** [1.051,1.215]
Divorced	1.050 [0.966,1.141]	1.047 [0.964,1.137]	1.050 [0.966,1.141]	1.047 [0.964,1.137]
Not satisfied with life	0.947 [0.825,1.086]	1.031 [0.898,1.185]	0.947 [0.825,1.086]	1.031 [0.898,1.185]
N	130250	130367		

Exponentiated coefficients; 95% confidence intervals in brackets * p<0.05, ** p<0.01, *** p<0.001.

APPENDIX 2D: Generalized Ordered Logit Estimates of Weight (age group 18-55)

	From Normal to Overweight		From Overweight to Obese	
	Before Instrumenting	After Instrumenting	Before Instrumenting	After Instrumenting
Insurance	1.120* [1.024,1.226]	1.259*** [1.187,1.335]	1.120* [1.024,1.226]	1.155*** [1.090,1.225]
Healthy	0.567*** [0.500,0.644]	0.544*** [0.479,0.618]	0.567*** [0.500,0.644]	0.544*** [0.479,0.618]
Age	1.029*** [1.026,1.032]	1.024*** [1.020,1.027]	1.020*** [1.017,1.024]	1.018*** [1.015,1.022]
No of Children	1.075*** [1.048,1.103]	1.053*** [1.030,1.077]	1.047*** [1.020,1.075]	1.053*** [1.030,1.077]
Physician visit	1.161*** [1.102,1.224]	0.917* [0.841,1.000]	1.161*** [1.102,1.224]	1.027 [0.939,1.123]
Male	2.465*** [2.331,2.607]	2.530*** [2.391,2.678]	1.263*** [1.190,1.341]	1.294*** [1.219,1.375]
Black	2.008*** [1.844,2.187]	2.125*** [1.948,2.318]	2.008*** [1.844,2.187]	2.125*** [1.948,2.318]
Other_race	0.612*** [0.544,0.689]	0.674*** [0.589,0.773]	0.612*** [0.544,0.689]	0.563*** [0.483,0.657]
Hispanic	1.142** [1.036,1.260]	1.387*** [1.231,1.562]	1.142** [1.036,1.260]	1.216** [1.075,1.375]
High School	1.099 [0.956,1.264]	1.042 [0.904,1.201]	1.099 [0.956,1.264]	1.042 [0.904,1.201]
Some College	1.153* [1.002,1.328]	1.046 [0.903,1.211]	1.153* [1.002,1.328]	1.046 [0.903,1.211]
College	0.779*** [0.675,0.898]	0.631*** [0.541,0.736]	0.729*** [0.631,0.842]	0.631*** [0.541,0.736]
Income15_25	1.081 [0.894,1.306]	1.037 [0.860,1.251]	1.081 [0.894,1.306]	1.037 [0.860,1.251]
Income25_35	1.080 [0.896,1.301]	0.960 [0.796,1.159]	1.080 [0.896,1.301]	0.960 [0.796,1.159]
Income35_50	1.044 [0.872,1.251]	0.823 [0.676,1.002]	1.044 [0.872,1.251]	0.823 [0.676,1.002]
Income50_	1.038 [0.866,1.244]	0.668*** [0.536,0.832]	0.915 [0.762,1.098]	0.668*** [0.536,0.832]
Married	1.207*** [1.120,1.301]	1.104* [1.021,1.193]	1.207*** [1.120,1.301]	1.104* [1.021,1.193]
Divorced	1.025 [0.936,1.122]	1.074 [0.971,1.188]	1.025 [0.936,1.122]	0.967 [0.872,1.072]
Not satisfied with life	0.927 [0.800,1.074]	1.021 [0.880,1.186]	0.927 [0.800,1.074]	1.021 [0.880,1.186]
N	108739	108845		

Exponentiated coefficients; 95% confidence intervals in brackets * p<0.05, ** p<0.01, *** p<0.001

Even though, binary logistic regressions result in ex ante moral hazard associated with obesity but not with smoking, it is possible to examine separately by dividing smoking and weight levels into categories in order to observe how the ex ante moral hazard impact differs among people having different weight and smoking categories. Following the same logic, by separating smoking status into categories might yield in ex ante moral hazard effect in any of the thresholds which is not possible to infer from binary logistic regression analysis. Appendix 2A and Appendix 2B present the generalized ordered logit estimates of smoking for the full and the restricted samples, respectively. In addition, Appendix2C and Appendix2D present the generalized ordered logit estimates of weight for the full and the restricted samples, respectively. There are two thresholds for each of the dependent variables and each threshold represent a movement to a higher category.

The results show that having a health insurance decreases the likelihood of moving up to a higher smoking category by relatively 30% before instrumenting for both of the samples and remains constant across thresholds. However, after instrumenting, it can be seen that the impact of insurance loses statistical significance in both threshold and in both samples. Albeit the point estimate of insurance on smoking implies that insured occasional smokers are slightly more likely to become a daily smoker in both samples, due to insignificance of the estimate the conclusion is that insured people are as equally likely to smoke as uninsured people disregarding their initial smoking levels.

However, the results present that a health insurance increases the likelihood of moving up to a higher weight category by relatively 12% before instrumenting for both of the samples and remains constant across thresholds. Moreover, after instrumenting, the impact of insurance becomes more effective, in the sense that for a currently normal weight individual, the existence of a health insurance increases the odds of moving to overweight/obesity level by 23.4% whereas for a currently overweight individual, it increases the odds of becoming obese by 15.6% in the larger sample. However, the magnitudes are slightly different for the restricted sample, resulting that insured people have higher likelihoods of moving up to higher weight categories, especially among currently normal weight people, insurance has larger impact than currently overweight people.